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Greener transport infrastructure – IENE 2014 International Conference

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Introduction

Transportation and infrastructure are recognised as significant drivers in the global loss of biodiversity. Their impacts on nature are well described (Forman et al. 2003, Davenport and Davenport 2006) and there is ample evidence for the negative effects of traffic and transportation infrastructure on nature. Even though roads and railroads may occupy small areas compared to e.g. forestry and agriculture, their ecological effects may reach a large portion of the landscape (Forman 2000, Benítez-López et al. 2010), cause the death of millions of wild animals (Seiler and Helldin 2006), and disturb surrounding habitats through pollution with chemicals (Stengel et al. 2006) and noise (Barber et al. 2010) and the spread of alien species (Vilà and Ibáñez 2011).

The overall impact of transport infrastructure on nature is evident, but there are means to minimise the pressure, to adjust infrastructure facilities and, to some degree, introduce beneficial services for wildlife (Forman et al. 2003, Iuell et al. 2003). Such measures can and should be implemented as a standard in infrastructure development and maintenance. However, knowledge about the functionality and efficacy of such measures is not always satisfying. Technical innovations and new mitigation concepts

need to be tested and evaluated. In addition, their functionality and effectiveness also depends on the interplay between the transport sector and other sectors of society. Communication, knowledge transfer, and public education are therefore just as essential as are legal frameworks, policies, technical development and environmental science. Current international policies in the field of nature conservation, such as the Aichi Biodiversity Targets under the UN Convention on Biological Diversity (UNEP 2010) and the EU-wide strategy on Green Infrastructure (European Commission 2013), are developing clearly in this direction, recognizing the transport sector and transportation facilities as important players in the endeavour towards a greener and sustainable future. Obviously, this calls for international collaboration in research and practice, for enhanced exchange of knowledge between disciplines, and for the development of harmonised standards and procedures that can be referred to by international actors.

To meet these demands, communities of practice have formed in several parts of the world (Wagner and Seiler 2015), such as the Australasian network for ecology and transportation (ANET, www.ecoltrans.net) in the Australasian region, the International Conference on Ecology and Transportation (ICOET, www.icoet.net) in North America, and the Infra Eco Network Europe (IENE, www.iene.info) in Europe.

IENE (Infra Eco Network Europe)

The Infra Eco Network Europe is a formalized network of mainly, but not exclusively, European authorities, institutes and individual experts working with the impacts of transport and infrastructure on nature and their mitigation (Spindler et al. 2014). Since 1996, IENE addresses decision makers, planners and researchers as well as the general public, and operates as an international and interdisciplinary arena to encourage and enable cross-boundary cooperation in research, mitigation and planning.

IENE national workshops and biannual international conferences on ecology and transportation provide recurring interdisciplinary forums for these activities. The conferences aim at presenting cutting-edge research, identifying urgent questions and problems, discussing effective solutions, and outlining the paths for upcoming activities in transport and infrastructure ecology.

The IENE 2014 International Conference brought together more than 200 professionals in the field of transportation, infrastructure and ecology, from 35 countries worldwide. With over 130 presentations and 6 workshops, the conference addressed the global ambition to achieve a "greener" and more ecologically sustainable transport infrastructure. Greener infrastructure stands for transport facilities that are well adapted to the ecological conditions of the surrounding landscape. The ambition for a greener infrastructure is expressed through striving for a wiser use of marginal infrastructure habitats to favour biodiversity and ecosystem services, for reduced disturbance and pollution by traffic, and for more permeable transport corridors that are safe for both humans and wildlife, and while acknowledging that not all impacts can be avoided and that certain areas must be kept roadless.

About this issue

This thematic issue of Nature Conservation compiles a selection of papers from the IENE 2014 conference. The following papers constitute a sample of the width of topics addressed in conference presentations and workshops, all aiming at providing guidance for management and conservation (see Seiler 2014 for all conference abstracts).

Many contributions to the conference dealt with the immediate conflict between traffic and wildlife. The presentations covered topics such as traffic safety and economic perspectives, wildlife management and conservation concerns, as well as challenges for effective reporting, registration and mitigation. In the focus of this work were often ungulates, as they combine wildlife management, safety, and economic issues (see also Bissonette and Rosa 2012). For example, Niemi et al. (2015), studied road mortality in ungulates based on collision and snow tracking data collected by Finnish hunters. They conclude that road mortality is very different among the species concerned and indeed rather high (6.5% of the wintering population of the most frequently killed deer species). Although road mortality unlikely creates a risk for viability of these ungulate populations, it may still require adaptation in wildlife management practices and hunting quotas to maintain abundant and stable populations.

A critical issue in wildlife accident statistics is the sometimes rather poor quality of data obtained from hunters, insurance companies or police. New technical development, however, allows for the involvement of first-hand reports from drivers (see also Olson et al. 2014). A growing number of countries is establishing reporting systems for citizen observations of road killed animals. Examples are presented from Belgium by Vercayie and Herremans (2015), and from California and Maine, USA, by Shilling and Waetjen (2015). Citizen science can be supported by new technologies, and provide road kill data with better extent in time and space than regular (often short-termed) scientific study, and with different extent and taxonomic accuracy (especially in smaller animals) than data collected by road maintenance or other officials. Citizen-reported data is useful both to prioritize sites for mitigation action and to raise public awareness on accident risks and conservation concerns. However, as citizen-reported data has a different focus and produces a different picture on traffic mortality in wildlife than official reports, it should be used as a complement to rather than as a replacement.

Another promising technical development are automated animal detection systems that intend to warn vehicle drivers when animals approach the road (see also Huijser et al. 2003). Grace et al. (2015) present tests from a driving simulator that indicated that the collision risk with large animals can be reduced significantly by such systems, especially if the alerts are picture-based rather than word-based. In fact, animal detection systems may be a cost-effective way to improve traffic safety for humans and wildlife, without creating the strong barrier effect on wildlife typically imposed by traditional exclusion fences.

Physical crossing structures may however be needed at certain location, to separate wildlife from traffic in a permanent manner and allow for safe passages for both animals and humans (see Beckmann et al. 2010). Such crossing structures vary in type

and size, depending on the target species (Iuell et al. 2003). For arboreal animals, that often experience a strong barrier in wide and busy roads, treetop bridges have proven effective. Here, Yokoshi and Bencini (2015) tell a success story of a rope-bridge that crosses a major road in Australia, effectively connecting small but important habitat patches for critically endangered possums.

As technical solutions to overcome the negative impacts of transport infrastructure and to maintain ecological connectivity typically have a rather local effect, it is important to plan them in a concerted action and in context of the surrounding landscape. Several countries have therefore developed comprehensive defragmentation plans (e.g., Voelk et al. 2001, Trocmé 2005, Bekker et al. 2011, BMU 2012). Also Favilli et al. (2015) highlight the importance of mitigation planning at a larger geographic and multidisciplinary scale. They describe how the most important barriers for large wildlife in the Carpathian mountain range were identified in trans-boundary cooperation. They further demonstrate the necessity of a broader, multiple-actors approach, as barriers for large wildlife involves also other factors than transport infrastructures alone.

Similarily, Persson et al. (2015) address the importance of a proper planning system with a broader scope for successful environmental conservation. In Sweden, compensation of negative environmental impacts of roads and railroads are rarely conducted despite both national and EU legislation calling for such action. The authors suggest stricter policies and better incentives for voluntary compensation to overcome this shortcoming.

The two final contributions to this thematic issue from the IENE 2014 conference take a contrary perspective to the previous by focusing on the positive potentials for nature conservation that are provided by habitats in infrastructure corridors. If managed appropriately, such habitats can sustain a variety of plant and animal life, including several endangered species, that may otherwise not be able to survive in the surrounding landscape (Vermeulen 1994, Bellamy et al. 2000, Milton et al. 2015). Spooner (2015) reviews the importance of roadsides for biodiversity and for producing ecosystem services in anthropogenic landscapes, using minor road networks in rural Australia as an example. While roadside management has its challenges, such as the risks of spreading of invasive species and creating ecological traps, and also is constrained by transport needs and safety concern, roadsides can be vital in providing connectivity and functioning ecosystems. Helldin et al. (2015) give examples of the importance of road and railroad verges as habitat refuges for rare or declining species in Scandinavia. They suggest that road and railroad managers adopt species for which they take a certain conservation responsibility, and use the occurrence of such responsibility species to set priorities for adapted verge management.

As the contributions to this thematic issue as well as other conference contributions show, a "greener transport infrastructure" can be achieved by effective mitigation of adverse effects and wise use of habitats managed within transportation corridors and facilities. However, it is also evident that not all negative impacts can be mitigated or compensated for. There will always be a residual and detrimental effect on nature. It is therefore only logical to conclude that in certain areas, where these residual effects are not acceptable,

construction of transport facilities should be entirely avoided. Such areas need to remain (or become again) roadless to provide sufficient undisturbed space for nature conservation (DeVelice and Martin 2001, Crist et al. 2005). Even within Europe, where only small and few roadless areas reside (Selva et al. 2011), this need is increasingly recognised. To support this development and highlight the value of roadless areas as complements to current biodiversity conservation in Europe, the participants at the IENE 2014 International Conference unequivocally asked for a pan-European strategy on roadless areas (IENE 2015).

To conclude, the IENE 2014 International Conference has highlighted the ecological and social benefits of roadless areas, outlined solutions for how transportation infrastructure can be developed without compromising these benefits. The conference and has also pointed out that the transport sector is able and willing to implement these solutions for a greener transport infrastructure.

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